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SYLLABUS

OF

A COURSE OF TEN LECTURES

ON

PHYSIOLOGICAL DISCOVERY:

A RETROSPECT, HISTORICAL, BIOGRAPHICAL, AND CRITICAL,

BY

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THE object of this course of lectures will be to trace the progress of physiological research from about the beginning of the sixteenth century to recent times, and more especially along those lines which have led to great results. Admitting that the deepest foundation of physiological science is a knowledge of structure, both of organ and of tissue, it will be the aim to show how physiology has gradually attempted to solve some of its problems by the methods of physics and of chemistry, and has thus become a branch of experimental science. The method followed will be to describe briefly the lives of the great discoverers, to indicate the influence of contemporary science on their ideas and opinions, and to show how their labours have brought us to our present position. As far as possible, the fundamental experiments of discoverers will be shown or illustrated, and these will be compared with present methods.

LECTURE I.—TUESDAY, *April 3rd*, 1883.

THE CIRCULATION OF THE BLOOD: A PROBLEM IN HYDRODYNAMICS.

HARVEY—BORELLI—MALPIGHI—HALES—POISEUILLE—LUDWIG—MAREY.

INTRODUCTION—Sketch of the opinions of the older anatomists as to the motion of the blood—Discovery of valves in veins, *Vesalius* (1514–1564)—Uses of valves, *Fabricius ab Aquapendente* (1537–1619)—Notions of *Servetus* (1509–1553) as to circulation through the lungs—The demonstration of the course of the circulation by *William Harvey* (1578–1657)—Sketch of the life of *Harvey*—Gradual development of the new doctrine of the circulation against much opposition—Investigations as to the structure of the heart and its mode of action by *Borelli* (1608–1679)—Demonstration of the circulation in the capillaries by *Malpighi* (1628–1694)—Transfusion practised by *Lower* in 1660—Investigation of the hydraulic phenomena of the circulation by *Stephen Hales* (1677–1761)—Sketch of the life of *Hales*—Introduction of mercurial manometer in 1826 by *Poiseuille* (*b.* 1799)—Measurement of velocity of blood-current by *Volkmann* (*b.* 1801)—*Vierordt* (*b.* 1818) and *Chauveau*—Theory of the circulation by *E. H. Weber* in 1850—Recording oscillation of the manometer by the kymograph by *Ludwig* in 1847 (*b.* 1816)—The pulse-measurer of *Poiseuille* and the sphygmometer of *Hérisson*—The sphygmographs of *Vierordt* and *Marey*—Application of graphic method by *Marey*.

LECTURE II.—TUESDAY, *April 10th*, 1883.

THE CIRCULATION OF THE BLOOD: THE CONTROLLING INFLUENCE OF NERVOUS SYSTEM.

WHYTT — CULLEN — JOHN HUNTER — PARFOUR DU PETIT — DUPUY — BRACHET—JOHN REID—E. WEBER—CLAUDE BERNARD—BROWN-SEQUARD.

Gradual rise of the notion that the vessels were not passive, but elastic and contractile tubes—Opinions of *Whytt* (1714–1766)—Of *Cullen* (1712–1790)—The observations of *John Hunter* (1728–1794) as to the different actions of the elastic and muscular coats of the blood-vessels—Early observations on the influence of nerves on vessels by *Parfour du Petit* (1664–1741), *Mollinelli* (about 1787), *Dupuy*, and *Brachet*—Discovery of influence of vagus nerve on heart by *Weber* (1845)—Researches of *John Reid* (1838)—A sketch of the life of *Reid* (1809–1849)—Researches of *Claude Bernard* (1813–1881) as to vascular nerves—Sketch of the life of *Claude Bernard*—Also corroborative observations of *Brown-Sequard*

(*b.* 1818)—Influence of these views of the relation of the nervous to the circulatory system on our present notions as to the distribution of blood, the action of remedies, and on theories of inflammation and of fever.

LECTURE III.—TUESDAY, *April 17th*, 1883.

RESPIRATION: RELATION OF THE ORGANISM TO THE AIR BREATHED—EXTERNAL BREATHING.

VAN HELMONT—BOYLE—MAYOW—PRIESTLEY—LAVOISIER—SPALLANZANI.

Early notions of *Van Helmont* (1577–1644)—Opinion of *Hales* as to mechanism of respiration—Erroneous ideas as to action of muscular structures in lungs (*Willis* 1622–1675, *Malpighi*, *Erasmus Darwin* 1731–1802) —Measurement of air breathed, by *Borelli* — Alleged experiments of *Sanctorius* in 1614 as to changes in the air breathed—Experiments by *Boyle* (1626–1691) showing that a supply of successive portions of fresh air is essential to life—The "nitro-aërial spirit" of *Mayow* (1645–1679)— Sketch of the life of *Mayow*—Artificial respiration introduced by *Hooke* (1638–1703)—The influence of the discoveries of *Boyle*, *Mayow*, and *Hooke* on theories of combustion and respiration—Discovery by *Black* (1728–1799) of carbonic acid ("fixed air") in expired air—Discovery of oxygen gas by *Priestley* (1734–1804)—The observations of *Lavoisier* (1743–1794) showing in respiration the absorption of oxygen, and production of carbonic acid— Observation of aqueous vapour eliminated from lungs by *Hales* and *Lavoisier* —The observations of *Sir H. Davy* (1778–1829) on nitrous oxide, and on respiration—Quantitative measurements by *Spallanzani* (1729–1799) as to the amount of oxygen absorbed and carbonic acid produced, and also that carbonic acid might be produced whilst breathing hydrogen—Sketch of the life of *Spallanzani*, and of the great scientific period from 1760–1800— Observations of *A. von Humboldt* (1769–1859) on aquatic breathing— Experiments of *Edwards* (1777–1842).

LECTURE IV.—TUESDAY, *April 24th*, 1883.

RESPIRATION: RELATION OF THE LIVING TISSUES TO THE GASES IN THE BLOOD.

MAGNUS — LOTHAR MEYER — LUDWIG — PFLÜGER — STOKES — HOPPE-SEYLER—PAUL BERT.

Gradual abandonment of the theory of *Lavoisier* that carbonic acid was produced in the lungs—Early attempts to obtain gases from the blood— The experiments of *Magnus* (*b.* 1802), in which he obtained gases by the use of a mercurial air-pump—Attempts to determine the coefficients of absorption of blood for oxygen and carbonic acid—Perfecting of the

methods of analysis of blood-gases by *Ludwig* (*b.* 1816), *Pflüger*, and *Lothar Meyer* (*b.* 1830)—The spectroscopic researches of *Stokes* and *Hoppe-Seyler*, showing the action of hæmoglobin, the blood-colouring matter, as a carrier of oxygen to the tissues—Observations by *Paul Bert* on the breathing of tissues—The result of these observations is to show that the blood is a respiratory medium for all tissues, and that the processes by which gaseous interchanges occur are of a physical character.

LECTURE V.—**MONDAY**, *April 30th*, 1883.

MUSCULAR TISSUE: ITS PROPERTIES AND MODES OF ACTION.

BORELLI—GLISSON—HALLER—WHYTT—JOHN HUNTER—GIRTANNER—WOLLASTON—WEBER—VON HELMHOLTZ—DU BOIS REYMOND—HEIDENHAIN—KÜHNE—HERMANN.

Early notions of the structure of muscle—Mathematical theories of *Borelli* founded on the assumption that muscular fibre consisted of a longitudinal series of hollow rhomboidal vesicles—*Borelli's* contributions to physiology—More correct ideas of *Prochaska* (1749–1820) and others—First use of term "irritability" by *Glisson* (1596–1634)—The doctrine of the inherent irritability of muscle established by *Haller* (1708–1777)—Sketch of the life of *Haller*—Controversy regarding this between *Haller*, *Whytt* (1714–1766), and others, which was of great importance as indicating the true relation of muscle and nerve—Opinions of *John Hunter* (1728–1794), *Bichat* (1771-1802), and *Girtanner* (1790)—Detection of the muscular sound by *Wollaston* (1766–1828)—Distinction between contractile and elastic action of muscle by *E. Weber*—Histological researches of *Bowman* (1840)—Recognition of identity of contractile "sarcous" particles in muscle with the protoplasm of humble organisms—Researches of *Von Helmholtz* (*b.* 1821) and *Du Bois Reymond* (*b.* 1819) by accurate methods of recording muscular contractions—The chemical and thermal changes in muscle investigated by *Heidenhain*, *Kühne*, and *Hermann*.

LECTURE VI.—TUESDAY, *May 8th*, 1883.

THE FORMATION OF THE BLOOD.

ASELLI—PECQUET—JOLLYFE—HUNTER—HEWSON—SPALLANZANI—MAJENDIE.

This process involves the digestion of food, the absorption of alimentary matters, and the action of special organs (blood-glands) in the production of blood-corpuscles.

1. Digestion: Old theories of the digestive process—Experiments of *Réaumur* (1683–1757) on digestion—More extensive researches of *Spallanzani* about 1783, in which he carried out artificial digestion—Experiments of *Tiedemann* (1781–1861) and *Gmelin* (1788–1853), and of *Prout* (1786–1850)—Observations of *Beaumont* on *Alexis St. Martin* (1822)—The works of *Bidder* and *Schmidt*, &c.

2. Absorption: Discovery of the lacteals by *Aselli* (1622), and of the thoracic duct by *Pecquet* in 1651—Discovery of lymphatics by *Jollyfe* (1652)—Observations by *Bertholin* (1616-1680) and *Rudbeck*—Opinions of *Boerhaave* (1668–1738) and *Haller* as to venous absorption—Opinions of *Wm. Hunter* (1718–1785) and the *Second Munro* (1733-1817)—Researches of *Majendie* of great importance (1783–1855)—Sketch of life of *Majendie*—The labours of *Hewson* on the formation of the blood and the action of the blood-glands—The life of *Hewson* (1739–1774).

Lecture VII.—Tuesday, *May* 15*th*, 1883.

THE MECHANISM OF SECRETION.

Malpighi—Johann Müller—Bowman—Goodsir—Ludwig—Heidenhain.

Structure of glands first investigated by *Malpighi* (1628–1694)—Fermentation theory of *Van Helmont* (1577–1644)—Filtration theories of *Descartes* (1596–1650) and *Leibnitz* (1646–1716)—Views of *Haller* (1708–1777) as to secretion—Attempt by *Sir Everard Home* (1756–1832) to trace connection between nerves and secretory organs—Opinions of *Wollaston* (1766–1828), *Thomas Young* (1773–1829), and *Benjamin Brodie* (1783–1862)—Experiments of *Philip*—Researches of *Johann Müller* (1830)—The influence of *Müller* (1801–1858) on physiological science in Germany—The structure of the kidney elucidated by *Bowman* (1842)—Reference of secretion to nucleated epithelial cells of gland-ducts by *Purkinje* (1838)—Opinion of *Schwann* (1838)—Observations of *Henle* (1838)—Examination of gastric glands by *Wasmann* (1839)—Examination of ink-bag of cuttle-fish by *Goodsir*—The influence of *Goodsir* (1814–1867) as a physiologist—Reference of all gland structures to a common type by *Sharpey* (1802–1880)—More recent researches by *Pflüger*, *Ludwig* (*b.* 1816), *Heidenhain*, and others, as to influence of nervous system on secretion, and as to the changes in the gland-cells.

LECTURE VIII.—TUESDAY, *May 22nd*, 1883.

THE NERVOUS SYSTEM: NOTIONS OF NERVOUS ACTION GENERALLY.

BAUHIN—HOFFMANN—SCHNEIDER—MALPIGHI—WILLIS—HALLER—UNZER—CHARLES BELL—JOHANN MÜLLER—WALLER—VON HELMHOLTZ—DU BOIS REYMOND.

Erroneous opinions of the ancients as to the structure of the brain and as to the use of the ventricles—Shown by *Bauhin* (1550–1624) and by *Hoffmann* (1572–1648) that "animal spirits" are generated in the brain—Opinions of *Conrad Victor Schneider* (about 1641)—Statement by *Malpighi* (1628–1694) that cortical part of brain is necessary to sensation and motion—Observations of *Thomas Willis* (1622–1675)—Use of term "vis nervosa," by *Haller* (1708–1777)—Vibration theory of *Hartley* (1705–1757)—Clearer notions of *Unzer* (1727–1799)—Strong distinction between motor and sensory nerves by *Sir Charles Bell* (1774–1842)—The law of "specific nervous energy" of *Johann Müller* (1801–1858)—Researches of *Waller* (*d.* 1870)—*Waller's* law of degeneration of nerve—Measurement of rapidity of nerve-current by *Von Helmholtz* and *Du Bois Reymond*—Propagation of "negative variation"—Recognition of *time* in all nervous changes.

LECTURE IX.—TUESDAY, *May 29th*, 1883.

NERVOUS ACTIONS: REFLEX ACTS AND THE SPINAL MARROW.

WHYTT—PROCHAZKA—MARSHALL HALL—BROWN-SEQUARD.

Notions of *Whytt* (1714–1766) as to sympathetic action of nerves—The theory of a "*sensorium commune*" as advanced by *Lancisi* (1654–1720), *Willis* (1662–1675), *Descartes* (1596–1650), *Boerhaave* (1668–1738), *Camper* (1722–1789)—Opinion of *Prochazka* (1749–1820)—Influence of the opinions of *Prochazka* on our present notions of nervous action—Theory of reflex action of *Marshall Hall*—Sketch of life of *Marshall Hall* (1790–1857)—Important experiments of *Brown-Sequard* (*b.* 1818)—Closer study of phenomena of reflex acts by *Pflüger*—Notions of the controlling power one nerve-centre may have over another, and of "inhibitory action"—The important practical results that have flowed from a knowledge of the mechanism of reflex acts.

LECTURE X.—TUESDAY, *June 5th*, 1883.

NERVOUS ACTION: THE HIGHER CENTRES AND THE BRAIN.

FLOURENS—CARPENTER—HITZIG—FRITSCH—FERRIER.

Sketch of the evidence as to the functions of the brain derived from (*a*) comparative anatomy; (*b*) development; (*c*) pathological effects; and (*d*) experiment—Influence of the theories of the early phrenologists, *Gall* (1751–1838) and *Spurzheim* (1776–1832)—The experiments of *Flourens* (*b.* 1820)—*Carpenter's* theory as to the reflex actions of the basal ganglia (about 1836)—General results of recent observations of *Ferrier* and others—Evidence in support of the theory of motor centres.

CONCLUSION: Show (1) that physiology collects evidence as to function from various sources, morphological, physical, chemical, experimental, and pathological; (2) that a sound physiology is the basis of the healing art; and (3) that whilst physiology is the handmaid of medicine, she also claims recognition as a science, investigating problems so recondite as to demand the highest methods of physics for their solution.
